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CONFEDERAZIONE SVIZZERA

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JAN 19 1999

JAMES R. CYPHER

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## BREVETTO PRINCIPALE

EV 073869225

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FEB 15 1999

JAMES R. CYPHER

Erberto Biggi, Massa Carrara (Italia)

## Procedimento per la costruzione di costruzioni edili

Erberto Biggi, Massa Carrara, (Italia), è stato designato come inventore

La presente invenzione ha per oggetto un procedimento per la costruzione di costruzioni edili prefabbricate mediante pannelli ad incastro. Forma parte integrante dell'invenzione il pannello ad incastro per l'esecuzione del procedimento medesimo.

Scopo dell'invenzione, è quello di realizzare un procedimento del genere citato, che permetta l'esecuzione di costruzioni edili con minimo impiego di mano d'opera, grande velocità di costruzione, e buone caratteristiche di coibenza e resistenza ad agenti atmosferici.

Secondo l'invenzione, il procedimento prevede le fasi di: preparare in fabbrica dei pannelli ad interpedine recanti lungo due bordi paralleli verticali degli incastri a maschio e femmina, montare in opera detti pannelli incastrandoli in successione per realizzare le pareti esterne ed interne, bloccare i bordi orizzontali delle pareti e gli spigoli mediante profilati metallici, ricavare nei detti pannelli i vani delle finestre, ed infine procedere alla copertura mediante strutture orizzontali poggianti sui detti profilati metallici e di irrigidimento.

Il pannello per l'esecuzione del procedimento consiste di due piastre sovrapposte fra loro e separate con due strisce parallele, di cui una sporge da un bordo per formare l'incastro-maschio, e l'altra è distanziata verso l'interno del pannello di una uguale distanza, per formare l'incastro-femmina.

Si ottiene così un pannello compatto, resistente, e provvisto di camera d'aria.

L'invenzione verrà ora descritta con riferimento ai disegni allegati, che rappresentano a titolo di esempio illustrativo e non già limitativo una preferita forma d'esecuzione dell'invenzione stessa.

Nei disegni:

la fig. 1 è una vista esplosa mostrante la costruzione di un pannello;

la fig. 2 è una vista parziale in prospettiva di un pannello costruito;

la fig. 3 mostra l'attrezzo misuratore impiegato per la costruzione dei pannelli;

la fig. 4 è una vista in sezione, mostrante l'unione di due pannelli di spigolo;

la fig. 5 è una vista in sezione orizzontale, mostrante il montaggio di un infisso;

la fig. 6 rappresenta il montaggio di un contro-telaio per finestra;

le figg. 7 e 8 rappresentano due soluzioni per il montaggio della copertura a tetto.

Con riferimento alle figg. da 1 a 3, il pannello comprende due lastre preferibilmente truciolari di qualunque tipo e marca in commercio (p. es. Eraclit, Populit, Carpilite, marche depositate)

Dette lastre 1 sono distanziate fra di loro da due strisce 2 e 3, dello stesso materiale che può avere spessori vari a seconda delle esigenze. La disposizione delle strisce 2 e 3 è tale che, mentre una è fissata qualche centimetro in profondità fra le due lastre, l'altra sporge di altrettanta distanza creando così un sistema d'incastri successivi fra pannelli a maschio e femmina. La distanza fra le due strisce costituisce una camera d'aria indicata con 4.

L'adesione delle lastre 1 e delle strisce 2 e 3 fra di loro, e che costituiscono un pannello, avviene impiegando collanti di ogni tipo in commercio oppure con cuciture metalliche a filamenti, con cuciture tessili oppure con grappe, chiodi, bulloni, viti o chiodi spartati, o qualsiasi altro mezzo idoneo.

Il pannello viene costruito nel modo seguente: su un piano orizzontale si posa una lastra dei tipi truciolari sopra descritti, indi con un misuratore « X » si procede a distanziare fra di loro le strisce 2 e 3 in modo che traguardate risultino una incollata all'interno della lastra (femmina) e l'altra sporgente a sbalzo nella stessa misura di quanto rientra la prima striscia (maschio). Fra le due strisce si costituisce la camera d'aria 4 avente nella parte superiore ed inferiore del costituendo pannello incollati o inchiodati due elementi in legno 5 di spessore uguale allo spessore delle strisce. Questo legno evita le sfrangiature nei trasporti e dà ulteriore controllo di distanza fra le strisce 2 e 3. Il tutto viene coperto previo collaggio con un'altra lastra truciolare a sua volta traguardata con il misuratore ed in perfetto filo e squadra alla prima lastra. Viene così costruito il primo pannello. L'operazione si ripete direttamente sopra il pannello per iniziare la successiva costruzione di un secondo e così via: più pannelli costruiti ed in tale modo sovrapposti, per effetto del peso proprio eliminano qualunque impiego di presse che si renderebbero necessarie nel tempo di essiccazione del tipo di collante usato.

Il pannello è autoportante, di buone qualità termoaustiche e imputrescibile.

Per la costruzione di un fabbricato i pannelli vengono incastrati uno nell'altro ed appoggiati su un ferro ad « I » 6 (figg. 4-8) di adeguate dimensioni e, tenendoli provvisoriamente puntellati, ricevono nella parte alta, un ferro ad « U » 7 le cui ali rivolte in basso sono distanziate fra di loro di una quantità pari allo spessore del pannello. Si costruisce così una parete di qualunque lunghezza previa congiunzione fra i profilati di ferro mediante normali piastre imbullonate ogni qualvolta necessita un'altra barra di profilato di ferro o altro materiale. Le congiunzioni angolari delle pareti (fig. 4) avvengono costruendo speciali profilati a « W » 8 di cui tutti i lati sono di lunghezza uguale allo spessore del pannello. Nella parte interna vengono applicati ferri piatti 9 di larghezza adeguata, corrispondenti alle facciate del profilato esterno, quindi vengono imbullonate fra questi profilati due posate ad angolo di qualunque grado. I pannelli terminali sugli angoli delle pareti sono costruiti in modo speciale e cioè facendo rientrare la striscia maschio sul filo delle lastre esterne creando così uno spessore tutto solido attraversato dai bulloni di connessione 10 come in fig. 4.

Le pareti vengono montate intere, senza cioè prevedere le aperture delle finestre che sono ricavate a pareti montate in qualunque punto e di qualunque dimensione praticando una incisione con seghe a catena motorizzate seguendo un tracciato. Nella luce creata viene applicato un controtelaio in legno 11 profilato ad « U » costruito con ali profonde in modo da coprire le imperfezioni di taglio e le sfrangiature. I profilati sono unghiate a  $45^\circ$  (vedi figg. 5 e 6) onde permettere l'innesto dei montanti e dei traversi di tutto il perimetro in cui viene montata una normale

finestra con persiana fissata con viti e borchie con davanzale in marmo. Coprifili sono previsti esternamente ed internamente fino alla copertura a sormonto del controtelaio. Le porte si ricavano di qualunque dimensione lasciando spazi vuoti fra i pannelli i quali presentano rivolti verso la luce voluta i due lati femmina che vengono riempiti con legno a forzare, per costruire il controtelaio su cui si può applicare un normale telaio porta o porta-balcone. Si possono prevedere sopraluci in legno a vetro perlinate per completare l'altezza totale della parete.

Nelle figg. 7 e 8 sono illustrate due soluzioni per la realizzazione della copertura.

Si prevedono sui profili 7 con sezione ad U rivolta verso il basso delle squadre di attacco per normali travature o capriate costituite da elementi che possono essere di qualunque forma, dimensione e quantità prevedendo secondo la soffittatura che si vuole applicare piastre forate per l'applicazione di regoli in legno 12 pronti a ricevere i pannelli stessi del soffitto all'interno ed i perlinati sull'esterno. La costruzione a questo punto è grezza; la rifinitura si può ottenere applicando normali intonaci da edilizia, lastre di cemento amianto, lastre di materiale plastico di qualunque genere, juta colorata, o altri materiali idonei. La tinteggiatura può essere eseguita seguendo gli schemi tradizionali.

## RIVENDICAZIONI

I. Procedimento per la costruzione di costruzioni edili, caratterizzato dal fatto di comprendere le fasi di: preparare in fabbrica dei pannelli ad intercapedine recanti lungo due bordi paralleli verticali degli incastrati a maschio e femmina, montare in opera detti pannelli incastrandoli in successione per realizzare le pareti esterne ed interne, bloccare i bordi orizzontali delle pareti e gli spigoli mediante profilati metallici, ricavare nei detti pannelli i vani delle finestre, ed infine procedere alla copertura mediante strutture orizzontali poggianti sui detti profilati metallici di irrigidimento.

II. Pannello per l'esecuzione del procedimento come a rivendicazione I, caratterizzato dal fatto di comprendere due piastre sovrapposte fra loro e distanziate da due strisce parallele, di cui una sporge da un bordo per formare l'incastro maschio e l'altra è distanziata verso l'interno del pannello di una eguale misura per formare l'incastro femmina.

## SOTTORIVENDICAZIONI

1. Procedimento secondo la rivendicazione I, caratterizzato dal fatto che le pareti formate dai detti pannelli vengono appoggiate lungo il bordo inferiore su un profilato ad L, mentre il bordo superiore è inserito entro un profilato ad U capovolto, ed il fissaggio dei pannelli sui detti profilati è realizzato tramite mezzi di fissaggio passanti.

2. Procedimento secondo la rivendicazione I, caratterizzato dal fatto che la giunzione dei pannelli in corrispondenza degli spigoli viene effettuata mediante

profilati metallici a W, fissati sui detti pannelli tramite bulloni passanti in cooperazione con delle contropiastre, applicate nel lato interno dei pannelli presso lo spigolo.

5 3. Procedimento secondo la rivendicazione I, caratterizzato dal fatto che i vani delle porte vengono ricavati interrompendo la serie dei pannelli per una distanza pari alla luce della porta e sistemando nel detto intervallo un telaio fornito di porta e sopraluce.

10 4. Procedimento secondo la rivendicazione I, caratterizzato dal fatto che i bordi dei pannelli in corrispondenza degli spigoli e dei vani delle porte presentano l'incastro maschio e vengono privati della parte sporgente.

15 5. Procedimento secondo la rivendicazione I, ca-

ratterizzato dal fatto che i vani delle finestre vengono ricavati asportando la relativa zona del pannello mediante sega a motore, e sistemato nel detto vano un controtelaio costituito da quattro elementi ad U con spigoli a 45°.

20 6. Procedimento secondo la rivendicazione I, caratterizzato dal fatto che la copertura viene sistemata su piastre metalliche a squadra, ancorate sui profilati di irrigidimento.

25 7. Pannello secondo la rivendicazione II, caratterizzato dal fatto che le piastre e le strisce sono formate da materiale truciolare.

Erberto Biggi

Mandatari: E. Blum & Co., Zurigo

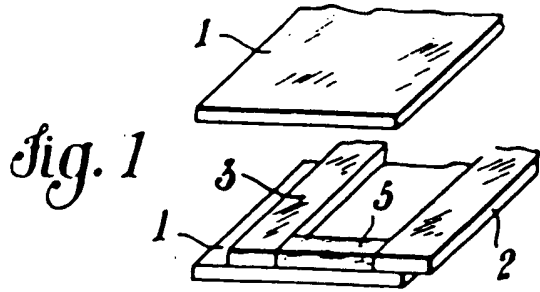


Fig. 1

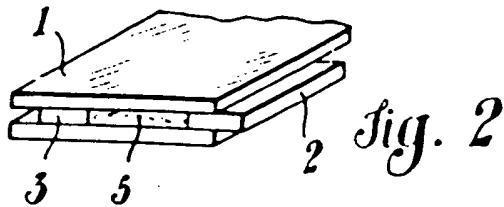


Fig. 2

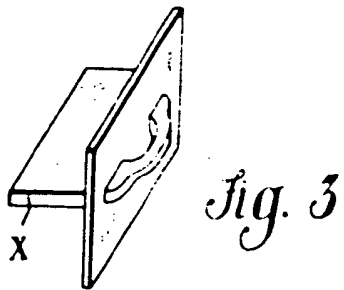


Fig. 3

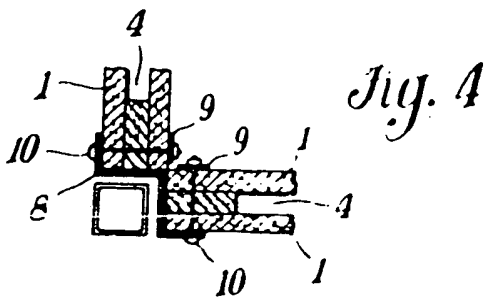


Fig. 4

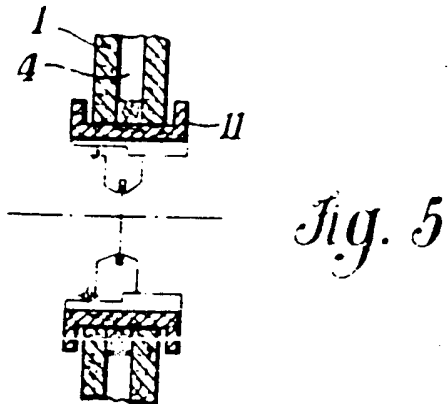


Fig. 5

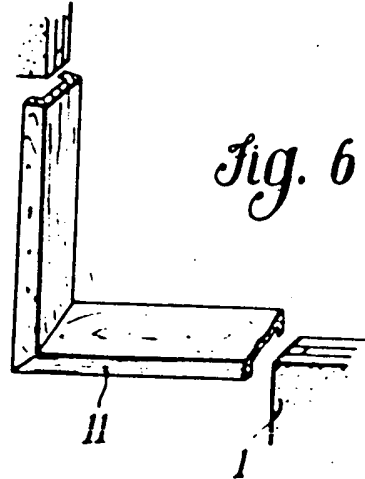


Fig. 6

Fig. 7

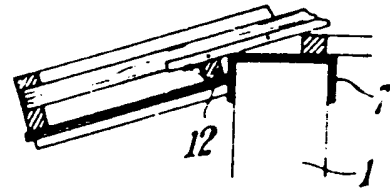
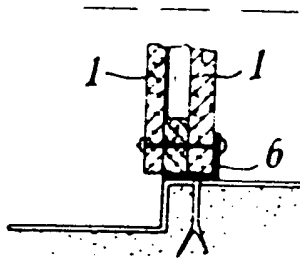
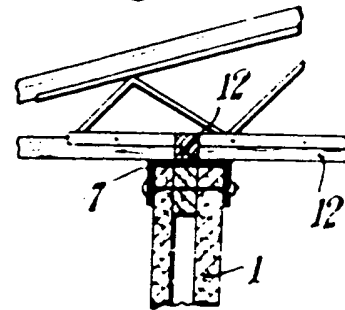


Fig. 8



No. 419 526

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PATENT SPECIFICATION

JAMES R. CYPHER

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[Handwritten:] SST 808

Class: 37 a, 1/02  
Int. Class.: E 04 b 1/02

[Swiss Emblem]

**SWISS FEDERATION**

Application No.: 16074.65  
Filing date: 11/22/65 at 5:15 pm  
Priority: Italy, 11/24/64

(25142/64)

**FEDERAL OFFICE OF INTELLECTUAL PROPERTY**

**MAIN PATENT**

[Mr.] Erberto Biggi, Massa Carrara (Italy)

**METHOD OF CONSTRUCTING BUILDINGS**

Erberto Biggi, Massa Carrara (Italy) has been designated as inventor

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The subject matter of this invention is a construction method used in building prefabricated buildings by means of interlocking panels. Said panels, used according to the subject method, are an integral part of this invention.

The purpose of this invention is to achieve a construction method, of the type mentioned above, which makes it possible to quickly build an insulated building that is resistant to the elements and requires minimum labor.

According to the invention, the above method includes the following steps: preparation at the factory of the cavity panels equipped with a male and a female interlock along their two vertical parallel edges; assembly of said panels by sequentially interlocking them in order to create the outside and inside walls; locking the horizontal edges of the walls and the corners by means of metal sections; creation of window openings in said panels; and, finally, assembly of the roof by means of horizontal structures supported by said metal sections and stiffening elements.

The panel used to carry out the above method consists of two superimposed boards with two parallel strips inserted between them. One of these strips protrudes on one side of the panel to become the male interlock. The other one is set back inside the panel - as much as the first strip protrudes from the panel - to create the female interlock.

The panel achieved with this method is compact, strong and is complete with airspace.

From this point on, the invention will be described by referencing the enclosed drawings. These drawings depict one example - but not limited to it - which is one of the preferred ways to execute this invention.

#### Drawings:

- Figure 1 is an exploded view showing how each panel is made up;
- Figure 2 is a partial perspective view showing an assembled panel;
- Figure 3 shows the measuring tool used to build the panels;
- Figure 4 is a cross-sectional view showing two panels secured at a corner;
- Figure 5 is a horizontal sectional view showing the installation of a casing;
- Figure 6 shows the installation of a window counterframe;
- Figure 7 and Figure 8 illustrate two options for installing the roof.

Observe Figures 1 and 3. The panels are comprised of two boards - preferably chipboards of any type or brand available on the market (i.e. Eraclit, Populit, Carpilite - deposited brands).

Said boards 1 are kept apart by two strips, 2 and 3, made of the same material, which can be of varying thickness according to situation requirements. Strips 2 and 3 are laid out so that one of the two is secured a few centimeters back between the two boards, while the other one extends the same distance [a few centimeters] from the two boards to create a system of subsequent male and female panel interlocks. The distance between the two strips creates an air space - indicated by the number 4.

Boards 1 and strips 2 and 3 are assembled together, to form a panel, using glue of any type available on the market or by using metal filament stitching/staples, textile stitching/staples or dogs, nails, bolts, screws or by using a nail gun, or any other appropriate means.

Each panel is built as follows: a chipboard, of the types explained beforehand, is laid on a horizontal plane. Then, strips 2 and 3 are positioned and properly spaced using a measuring tool  $\hat{X}$  so that one is glued back inside the board (female) and the other one extends out by the same distance (male). These two strips and the two wooden elements 5 that are glued or nailed into place in the upper and lower part of the panel that is being assembled create air space 4. The thickness of the two elements 5 is equal to the thickness of the strips. These wooden pieces prevent feathering problems during shipment and assure that strips 2 and 3 remain in their correct position/distance. After application of the glue, these parts are covered with another chipboard, which is also positioned using the measuring tool. This chipboard must be perfectly flush and square with the first board. This is how the first panel is built.

The second panel is built by repeating the aforementioned procedure directly on top of the first panel, and so on. The panels are built and laid on top of each other in this manner during assembly and because of their weight, there is no need for presses which are normally required during the drying time of the glue used in the process.

This type of panel is self-supporting and offers good thermoacoustic properties, and it does not rot.

In order to construct a building, the panels are locked into each other and held by an  $\hat{L}$  shaped steel element 6 (Figures 4-8) of the appropriate size. While the panels are being momentarily held in place, a  $\hat{U}$  steel channel 7 is lowered on top of them. This element is equipped with wings pointing downward. The distance between each wing is equal to the thickness of the panel. By following this method, it is possible to build a wall of any length by first joining the steel sections together using normal bolted down boards any time a steel section rod, or another material, is required. The walls are joined at the corners (Fig. 4) by special  $\hat{W}$  shaped sections 8, that are built so that the length of each side matches the thickness of the panel. The flat steel elements 9 are installed on the inner side and are appropriately sized so that they match the faces of the external structural section. Then, two anchoring angles are bolted at any angle between these sections. The terminal panels on the corners of the walls are built in the following special manner: the male strip is set back, flush with the external boards, thus creating a completely solid assembly through which the connection bolts 10 are driven, as in Figure 4.



The walls are installed whole, before creating the openings for the windows. The windows are cut, in any location and in any size with a motor chain saw, along the desired pattern, after the walls are installed. After cutting the window opening, a wooden U shaped counterframe 11 is installed. This counterframe is built with deep wings to cover any cutting imperfections and any fraying that may be present. These sections are beveled at 45 degrees (see Figures 5 and 6) so that it is possible to install the posts and the cross beams for the entire perimeter to allow installation of a normal window with shutters - secured with screws and bosses - and marble sill. Staff beads are placed both externally and internally to create an overlapping coverage of the counterframe. The open area for the doors can be made in any size by simply leaving out the necessary panels. The two panels face the open area for the door with their female side, which is force filled with wood to build the counterframe on which a normal door or balcony door frame will be mounted. It is possible to design wooden transoms with beaded glass to fill up the total height of the wall.

Figures 7 and 8 illustrate two roofing options.

The following is to be installed on structural profiles 7, with U-shaped downward channel: anchoring squares for normal trusses or king-post trusses, made out of elements that can be of any shape, size and quantity. It is necessary to take into consideration the need for perforated plates/boards - depending on the type of ceiling that it is going to be installed - which are necessary for applying wooden lists 12. These wooden lists are ready to receive/install ceiling panels, internally, and beaded panels on the outside. At this point, the building is still unfinished. The finishing can be done by applying normal construction plaster, boards of asbestos cement, boards of plastic material of any type, colored jute or other appropriate materials. Painting can be done in the traditional way.

## CLAIMS

I. A Method to build buildings characterized by the fact that it includes the following phases: Preparation of the cavity panels at the factory - these panels feature, along the two parallel vertical edges, a male and a female interlock element; Assembly of said panels on location by interlocking them to create the outside and inside walls; Locking of the horizontal edges of the walls as well s locking of the corners by means of metal sections; Cutting out the openings for the windows in said panels; and, finally, Roofing by means of horizontal structures resting on said stiffening metal sections.

II. Panel used according to the method illustrated at point I, characterized by the fact that it includes two overlapping boards which are spaced out by two parallel strips. One of these strips, the male interlock, extends out of one side, while the other one, the female interlock, is set back into the panel. The measurement of the protruding section of the male interlock equals the measurement of the female interlock set back. -

## SUBCLAIMS

I. The method according to Claim I characterized in that the lower edge of the walls created by above panels rest on an L shaped angle iron, while the upper edge is inserted in an upside down U-shaped channel. The panels are secured to said sections through pass-through locking elements.

2. The method according to Claim I characterized in that the panels are joined at the corners by means of W shaped metal sections that are secured on said panels by means of bolts and counterplates that are installed by the corner on the inner side of the panels.

3. The method according to Claim I characterized in that the openings for the doors are created by interrupting the series of panels over a distance that is equal to the opening of the door. A frame complete with door and transom is installed in said opening.

4. The method according to Claim I characterized in that the panel edges, at the corners and at the openings left out for the doors, which feature the male interlock, lose the protruding part of said element.

5. The method according to Claim I characterized in that the window openings are obtained by cutting out the appropriate area of the panel using a motor saw. The counterframe installed in said opening consists of four U-shaped elements with 45 degree corners.

6. The method according to Claim I characterized in that the roofing is installed on metal plates/boards at right angles. Said metal plates/boards are anchored onto the stiffening sections.

7. The panel according to Claim II, which is characterized in that the boards and the strips are made of chip material.

[Mr.] Erberto Biggi

**Representatives:** E. Blum & Co., Zurich.

-1- (WPAT)

AN - 98-004672/01

XRPX- N98-003514

TI - Multistorey building structure - makes each pair of several portal frames, installed on pillars and beams already built with earthquake-proof walls, run longitudinally or laterally and are perpendicular to building height

DC - Q43

PA - (SHMC ) SHIMIZU CONSTR CO LTD

PR - 96.04.08 96JP-085561

NUM - 1 patent(s) 1 country(s)

PN -- JP09273214 A 97.10.21 \* (9801) 4p E04B-001/18

AP -- 96JP-085561 96.04.08

IC1 - E04B-001/18

AB - JP09273214 A

The structure includes several large beams (2) constructed between the pillars (1). An earthquake-proof wall (4) is enclosed between each pairs of pillars and beams. Each wall is also arranged as such that a portal can be constructed between the pillars and beams.

Several portal frames (5) are installed over the entire building height where the walls are installed. Each pair of portal frames runs laterally and longitudinally and are both perpendicular to the building height.

ADVANTAGE - Reduces piling of large beams. Increases pillar interval. Reduces pull acting on building. Uses installation space by enlarging floor amount. (Dwg.2/3)

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-1- (WPAT)

AN - 97-533728/49

XRPX- N97-444336

TI - Earthquake proof frame for entrance of wooden building used as e.g. garage, car port, shop - uses connectors e.g. lag screws to couple left and right L-shaped sections of square body on pillars and lintel, and stone bolts to couple bottom ends of square body on foundation

DC - Q46 Q48

PA - (JKEN-) J KENCHIKU SYSTEM KK

PR - 96.03.25 96JP-096216

NUM - 1 patent(s) 1 country(s)

PN -- JP09256738 A 97.09.30 \* (9749) 8p E06B-001/02

AP -- 96JP-096216 96.03.25

IC1 - E06B-001/02

IC2 - E04H-009/02 E06B-001/60

AB - JP09256738 A

The frame has a pair of pillars (3,4) concurrently installed on the upper

surface of a foundation (2). A square body (7) is installed in a square opening (6) and includes left and right L-shaped sections (7A,7B). A lintel (5) is horizontally laid on the upper surface of the pillars.

Several connectors (10) e.g. lag screws are used to respectively couple the left and right L-shaped sections on the pillars and lintel. The bottom ends of the square body are installed on the foundation through stone bolts (12).

ADVANTAGE - Obtains entrance with proof stress wall by providing earthquake proof square body. Supports building during strong earthquake by preventing generation of big displacement moment due to strong vibration, thus preventing collapsing of building and ensuring safety of occupants. Saves construction material and time by obtaining small proof stress wall. Shortens construction process by using prefabricated earthquake proof square body. Enables adjustment of width of opening during attachment of earthquake proof square body, when e.g. sash is different. (Dwg.1/13)

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XP-002077454

- /1 - (C) WPI / DERWENT
- N - 98-358235 31!
- P - JP960312909 961107
- R - JP960312909 961107
- I - Two storey building with frame wall - has structural plywood panels fixed to vertically and horizontally attached frames and horizontal structural members coupled with metal plate by nailing
- W - TWO STOREY BUILD FRAME WALL STRUCTURE PLYWOOD PANEL FIX VERTICAL HORIZONTAL ATTACH FRAME HORIZONTAL STRUCTURE MEMBER COUPLE METAL PLATE NAIL
- A - (OKAW-I) OKAWA T
- N - JP10140653 A 980526 DW9831 E04B1/10 009pp
- RD - 1998-05-26
- C - E04B1/10
- S - GMPI
- C - Q43
- B - J10140653 The building has several horizontal structural members (1) on the top and bottom floors, which are coupled by several vertical panels (4). The panels are formed by fixing structural plywood (4A) to attached a frame unit (5) consisting of several horizontally attached frames (5A) and vertically attached frames (5B). The structural plywood protrudes beyond the attached frames in the up and down directions.
  - Plate shaped coupled metal plates (6) are fixed on the surface of the structural plywood using nails which fix the coupled metal plate and structural plywood with the frames and horizontal structural members. The nails are hammered through nail holes provided in the coupled metal plate and stopped after the nail penetrates the structural plywood, frame and horizontal structural members.
  - ADVANTAGE - Improves aseismic property. Simplifies construction. Improves strength of wall.
  - (Dwg. 4/12)

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-1- (WPAT)

AN - 98-441157/38

XRPX- N98-343755

TI - Steel earthquake-resistance wall for e.g. engineering structure, plant structure, architectural structure - has two puncheons which are individually combined to combination structure of steel plates and installed between top and bottom beams such that rectangular opening is formed in between puncheons

DC - Q43 Q46

PA - (NIKN ) NKK CORP

PR - 96.12.24 96JP-343965

NUM - 1 patent(s) 1 country(s)

PN -- JP10184076 A 98.07.14 \* (9838) 6p E04H-009/02

AP -- 96JP-343965 96.12.24

IC1 - E04H-009/02

IC2 - E04B-002/56

IB - JP10184076 A

The wall (1) includes a low-yield stress steel plate (3) installed in a structure main frame enclosed by a pair of iron-steel beams (12) and pillars (11). The combination of the steel plates prevents the deformation and collapse of a predetermined structure during earthquake.

Two puncheons (7), which are combined to the combination structure of the steel plates, are installed between the top and bottom beams. A rectangular opening (6) is formed between the puncheons. A non-rigid plate material (9) with a lateral member (8a) on the edge, is formed in one side section of the opening.

ADVANTAGE - Ensures effective force and energy for earthquake resistance capability since stress and distortion are concentrated in opening. Reduces damage of predetermined structure. Offers high rigidity and strength at low cost since inexpensive puncheons or surface

materials

are utilised. (Dwg.1/7)

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SS 2?

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